1995-96 Observations of Atmospheric Dust/Water Ice Relationships in the Mars Climate

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Microwave sounding of the global average temperature profile of Mars (z=0-50 km) was conducted in 1995-96 over the solar longitude (L_s) range of $57 - 330^\circ$. During the northern spring aphelion period ($L_s = 57 - 74^\circ$), cold (low dust) atmospheric conditions corresponding to very low altitudes of cloud formation were observed (Clancy et al., Icarus, 122, 36-62, 1996). However, observations during the northern summer/fall season ($L_s = 116 - 203^\circ$) indicate 20 K increases in temperatures of the lower atmosphere (z<20km). Such behavior was not observed in the same season in 1988, 1990, and 1993. However, this heating is comparable to that observed by the Viking lander descents in 1976 at $L_s = 100^\circ$, although it does not extend to as high altitudes (z>30 km) as observed during the Viking period. Coincident with this 1995 northern summer heating were Hubble Space Telescope observations of regional dust storm and ice cloud activity at $L_s = 82 and 145^\circ$ (Wolff et al., submitted to JGR,1996). The microwave temperature observations indicate a remarkable correlation between the inferred peak altitude of dust heating and the implied saturation altitude of water vapor in the Mars atmosphere, which persisted even during more extensive (z>40 km) atmospheric heating observed over the $L_s = 222 - 330^\circ$ perihelion dust storm season in 1996. These observations are considered in the context of nonlinear interactions between dust and water ice aerosols, which may contribute considerable seasonal and interannual forcings in the current Mars climate.

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